

REMARKS

Entry of the foregoing and reconsideration of the subject application are respectfully requested in light of the amendments above and the comments which follow.

As correctly noted in the Office Action Summary, claims 1-19 and 47-50 were pending with claims 11-19 withdrawn. By the present response, claims 1 and 50 have been amended and claims 11-19 and 49 canceled. Thus, upon entry of the present response, claims 1-10, 47-48 and 50 remain pending and await further consideration on the merits.

Support for the foregoing amendments can be found, for example, in at least the following locations in the original disclosure: the original claims and the specification, page 4 line 29 to page 5, line 25.

Entry of the foregoing is appropriate pursuant to 37 C.F.R. §1.116 for at least the following reasons. First, the amendments raise no new issues that would necessitate further search and/or substantive reexamination. Second, the amendments clearly overcome the grounds of rejection.

CLAIM REJECTIONS UNDER 35 U.S.C. §102

Claims 1-10 and 47-50 stand rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,361,892 to Ruhl et al. (hereafter "*Ruhl et al.*") on the grounds set forth in paragraph 5 of the Official Action. For at least the reasons noted below, this rejection should be withdrawn.

The present application is generally directed to microtextured ion exchange system structures. Generally, fuel cells are stacks or multiple layers of alternating separators and electrodes or membrane electrode assemblies (MEA). The fuel is

appropriately distributed by the separator into the electrodes of the fuel cell where the reaction occurs. In the present application, applicants disclose microtexturing by laser radiation the reactive surface area of a substrate to which is delivered the fuel of the fuel cell. The increased reactive surface area has two scales of roughness that improves the reaction efficiency and the overall efficiency of the fuel cell. To obtain the two scales of roughness, applicants disclose at page 4, line 33 to page 5, line 25 disclose several specific examples. For example, one exemplary embodiment includes laser ablating at “a frequency and feed rate and fluence above the substrate ablation threshold and below the debris ablation threshold.” These conditions are disclosed as “encourage the resettling of the debris 111 back onto the surface 109 of the substrate.” In some examples, the two scales of roughness include a cone structure 113 with debris 111 attached. Length scales of microns and nanometers are disclosed for the two scales of roughness.

The exemplary features are generally embodied in Applicants' independent claim. For example, amended claim 1 recites that a substrate for an ion-exchange electrode structure comprises, *inter alia*, an exterior surface wherein at least a portion of the exterior surface is irradiated by a laser radiation to enlarge a reactive surface area on the exterior surface. The reactive surface area has two-scales of roughness, a first scale of roughness at least three orders of magnitude different than a second scale of roughness.

The Examiner has referenced *Ruhl et al.*, which discloses reactant microchannels in electrodes of a fuel cell. The microchannels transport reactant gas. See Abstract. *Ruhl et al.* further discloses that the variable cross-section microchannel pattern serves to distribute the flowing gas uniformly within the

electrode, regulates the pressure drop of this gas, and also creates preferred local gas velocities especially where the gas exits the electrode.

Comparing the disclosure in *Ruhl et al.* to the claims of the present application at issue here, the *Ruhl et al.* patent does not specifically mention the microchannels have a reactive surface area having two-scales of roughness, a first scale of roughness at least three orders of magnitude different than a second scale of roughness. In light of at least this difference, Applicants respectfully submits that an anticipatory rejection is improper since *Ruhl et al.* does not disclose the invention as claimed

Ruhl et al. does disclose forming the microchannels by “a variety of conventional substrative techniques” including laser ablation. See, column 8, lines 21-25. The Examiner relies upon this *de minimis* disclosure of laser ablation to form microchannels and alleges that the claimed properties of claims 47-50 (which includes the feature of the reactive surface area has two-scales of roughness, a first scale of roughness at least three orders of magnitude different than a second scale of roughness (prior claim 49)) would be inherent.

Applicants respectfully disagree with the Examiner. The Examiner incorrectly relies upon the doctrine of inherency when alleging that the laser ablation of the *Ruhl et al.* microchannels inherently results in the same surface features that are set forth in the claims of the present invention, e.g., projecting surface feature, cone-shape, two scale roughness and first scale roughness of 10^{-6} meters. However, the Examiner has clearly incorrectly applied the doctrine of inherency. *Ruhl et al.* does disclose forming the microchannels by “a variety of conventional substrative techniques” including laser ablation. See, column 8, lines 21-25. However:

In order for a claimed element to be "inherent" in a prior art reference, the claimed element or feature must necessarily result from the prior art. "Such evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill." and "Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient."

Continental Can Co., U.S.A. v. Monsanto Co., 20 U.S.P.Q.2d 1746, 1749 (Fed. Cir. 1991).

In other words, for the claimed two-scale roughness (and other surface features) to be inherent in *Ruhl et al.*, every surface formed by laser ablation that could be used in the *Ruhl et al.* reference must have the claimed two-scale roughness. There is simply no showing by the Examiner to this standard. It is not sufficient that a surface formed by laser ablation as set forth in the *Ruhl et al.* disclosure may have the claimed two scale roughness (or any of the other claimed surface features). See, In re Rijckaert, 28 U.S.P.Q.2d 1955, 1957 (Fed. Cir. 1993). ("The mere fact that a certain thing may result from a given set of circumstances is not sufficient to establish inherency.").

Although a device manufactured according to the teachings of *Ruhl et al.* may have the same surface features set forth in claim 1 of the present application, there is no reason based on the teachings of *Ruhl et al.* that such a surface must necessarily result. Indeed, to form micro-channels in structures by laser ablation, such as disclosed in *Ruhl et al.*, one must laser ablate above the debris threshold, e.g., above the debris threshold to remove materials to form the channel. Also, to obtain the channels of his size and length, not to mention also having suitable and reproducible transport properties, one must laser ablate above the debris threshold.

Thus, because *Ruhl et al.* operates above the debris threshold, the disclosed laser ablating cannot inherently form the claimed two scale roughness.

Furthermore, *Ruhl et al.* is not concerned with the reactive surface area resulting from the laser ablation nor is he concerned with increasing or in any way altering the surface area of a reactive surface of a fuel cell. Rather, *Ruhl et al.* merely addresses the problem of distribution of fuels within a fuel cell and uses laser ablation to fabricate the micro-channels 26. Thus, *Ruhl et al.* does not disclose any special laser ablation technique that would result in the two scale roughness as presently claimed. Applicants respectfully note that they have disclosed that the claimed two-scale roughness is a result of laser ablation under the specified conditions and does not result from laser ablation under all conditions.

Accordingly from the above discussion, Applicants respectfully assert that the claimed surface feature, e.g., two scale roughness, is not inherent in *Ruhl et al.* The rejection set forth by the Examiner is based on an incorrect understanding of the doctrine of inherency. Thus, the rejection must be withdrawn.

In light of at least the above-noted differences, Applicants respectfully assert that an anticipatory rejection based on the disclosure in *Ruhl et al.* is improper, because each and every element of applicants' independent claim is not disclosed therein. Accordingly, withdrawal of this rejection is respectfully requested.

Claims 1-3, 8, 9 and 47-50 stand rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,471,993 to Shastri et al. (hereafter "*Shastri et al.*") on the grounds set forth in paragraph 6 of the Official Action. For at least the reasons noted below, this rejection should be withdrawn.

First, Applicants respectfully disagree with the Examiner's interpretation of the disclosure in *Shastri et al.* As previously presented, the disclosure of *Shastri et al.* is directed to polymer matrices formed in a mold by precipitation. See column 11, lines 22, *et seq.* and line 44. The disclosure of laser ablation at column 16, lines 52-57 merely notes that the formed polymer matrix can be further shaped by laser ablation, micromachining, the use of a hot wire, and by CAD/CAM processes and does not disclose increasing a reactive surface layer by laser ablation. In other words, *Shastri et al.* merely uses laser ablation (among other techniques) for forming the outer, overall rough shape of the porous polymer matrix formed in the previously disclosed mold.

The disclosure at column 23, lines 2-9, of the use of the matrices for porous electrodes does not change the above noted disclosure to include using laser ablation to form reactive surfaces as presently claimed. Rather, as disclosed in column 17 beginning at column 10, it's clear from *Shastri et al.* that the voids or interior surface of the polymer matrix, which form the reactive surfaces in the disclosed porous electrodes, are formed by precipitation. In contrast, Applicants' independent claim 1 references an exterior surface roughened by laser ablation to enlarge a reactive surface area, e.g., the reactive surface area is an exterior surface. In other words, the reactive surface of *Shastri et al.* is not an exterior surface roughened by laser ablation to enlarge a reactive surface area.

Thus, for at least this reason, Applicants respectfully assert that an anticipatory rejection based on the disclosure in *Shastri et al.* is improper, because each and every element of applicants' independent claim is not disclosed therein.

Second, the Examiner has misapplied the doctrine of inherency in this case. The Examiner acknowledges that *Shastri et al.* does not specifically disclose surface features and scale of roughness resulting from laser ablation. The Examiner then alleges that the claimed features would be inherent.

However, and as discussed above with respect to the alleged inherent features in *Ruhl et al.*, for the claimed two-scale roughness (and other surface features) to be inherent in *Shastri et al.*, every reactive surface formed by laser ablation that could be used in the *Shastri et al.* reference must have the claimed two-scale roughness. There is simply no showing by the Examiner to this standard. Even if the *Shastri et al.* reference disclosed forming such reactive surfaces by laser ablation (which it doesn't – see above discussion), is not sufficient that a surface formed by laser ablation as allegedly set forth in the *Shastri et al.* disclosure may have the claimed two scale roughness (or any of the other claimed surface features). See, In re Rijckaert, 28 U.S.P.Q.2d 1955, 1957 (Fed. Cir. 1993). ("The mere fact that a certain thing may result from a given set of circumstances is not sufficient to establish inherency.").

Even if a device manufactured according to the alleged teachings of *Shastri et al.* were to have the same surface features set forth in claim 1 of the present application, there is no reason based on the teachings of *Shastri et al.* that such a surface must necessarily result. *Shastri et al.* does not disclose any special laser ablation technique that would result in the two scale roughness as presently claimed. Applicants respectfully note that they have disclosed that the claimed two-scale roughness is a result of laser ablation under the specified conditions and does not result from laser ablation under all conditions.

Furthermore, even if the disclosure in *Shastri et al.* includes gross forming of an outer shape of a structure by laser ablation, this is still removal of material by laser ablation. Such removal of material occurs above the debris threshold. Thus, because *Shastri et al.* operates above the debris threshold, the disclosed laser ablating cannot inherently form the claimed two scale roughness.

Accordingly from the above discussion, Applicants respectfully assert that the claimed surface feature, e.g., two scale roughness, is not inherent in *Shastri et al.* The rejection set forth by the Examiner is based on an incorrect understanding of the doctrine of inherency. Thus, the rejection must be withdrawn.

In light of at least the above-noted differences, Applicants respectfully assert that an anticipatory rejection based on the disclosure in *Shastri et al.* is improper, because each and every element of applicants' independent claim is not disclosed therein. Accordingly, withdrawal of this rejection is respectfully requested.

CONCLUSION

From the foregoing, further and favorable action in the form of a Notice of Allowance is earnestly solicited. Should the Examiner feel that any issues remain, it is requested that the undersigned be contacted so that any such issues may be adequately addressed and prosecution of the instant application expedited.

Respectfully submitted,

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